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Defoliation by the Gypsy Moth: How it Hurts Your Tree

Defoliation by the Gypsy Moth: How it Hurts Your Tree

by
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In 1974 the U.S. Department of Agriculture initiated the Combined Forest Pest Research and Development Program, an interagency effort that concentrated on the Douglas-fir tussock moth in the West, on the southern pine beetle in the South, and on the gypsy moth in the Northeast. The work reported in this publication was funded in whole or in part by the program. This manual is one in a series on the gypsy moth.

Figure 1.—Ragged foliage that has been chewed by the gypsy moth caterpillar.

Leaves are a pleasant background for our houses and provide relief from a hot sun. They also act as air filters by removing dust and pollutants from the atmosphere, and buffer our ears from the noises generated by our daily activities. Leaves also provide beauty and color throughout the year. The main purpose of leaves, however, is to produce food for the tree so it can produce wood and more leaves for the next year.

Defoliation caused by hungry gypsy moth caterpillars (larvae) eating the leaves may deprive us of a tree's beauty and benefits temporarily for 1 or several years (figs. 1 and 2). But we might be left permanently without these benefits, because defoliation can result in dead, leafless trees (fig. 3).

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2

When an oak tree (the primary food source of the gypsy moth) loses its leaves for any reason other than the onset of winter, its natural growth and food-making cycles are interrupted. The tree may not produce enough food and may have to use its food reserves. This can weaken the tree, leaving it vulnerable to attack by insects and fungi.

Figure 2.—Closeup of the gypsy moth caterpillar in its later growth stages when it is fairly large.

Whether a tree ends up as a cutoff stump or a functional living tree after defoliation depends on how badly the tree was affected by defoliation, and this depends on:

- How much foliage was eaten
- If the tree refoliated
- How many years in succession the tree was defoliated
- When during the year defoliation occurred
- What the weather conditions were after defoliation
- If disease organisms and other insects attacked the tree
- How healthy or vigorous the tree was before defoliation.

These criteria are discussed in this booklet. When you finish reading, you should understand why defoliation hurts your tree and have some idea about your tree's chances for survival if it has been defoliated by the gypsy moth. While this booklet does emphasize defoliation of oak trees by the gypsy moth, the information applies to defoliation of other deciduous trees (a tree that sheds its leaves each autumn) and to other insects.

Figure 3.—Oak trees that have died after heavy gypsy moth defoliation. Oaks in foreground have been cut down for firewood.

1. How much foliage was eaten?

One of the most important factors is how much foliage was eaten by the gypsy moth caterpillar. The more foliage the insect eats, the less food is produced for the tree (fig. 4).

The worst situation for the tree is when all the foliage has been eaten. With all the leaves gone, the tree has no food-producing system, and it must live off its reserve foods until the new leaves appear. These reserve foods are used normally to feed the tree during the winter resting period. If the tree enters winter with low food reserves, some parts of the tree may die.

Apparently a tree can lose up to half its foliage before it begins to suffer. When more than half the foliage is eaten, the tree begins to change because not enough food and other growth substances are being produced.

Figure 4.—Oak trees in various stages of defoliation: *A*, No defoliation; *B*, light defoliation; *C*, moderate defoliation; *D*, heavy defoliation.

5 A

B

At some point, enough tree leaves are eaten to cause the tree to produce new leaves—refoliation—and this is bad for the tree. The tree then behaves as if autumn and spring have arrived together. The remaining pieces of leaf and leaf stems are shed just like they are in autumn, but without a color change. Then, the changes that bring a tree from the resting state to full leaf in the spring occur again. In 2 to 3 weeks, new leaves begin growing. This "spring again" condition may be necessary for the tree to survive, but because reserve foods are used, it puts a tremendous strain on the tree.

Even with the new leaves, the tree is still at a disadvantage. The new leaves are only half the original size and are fewer in number than before defoliation (fig. 5). The new leaves are usually a lighter green, which indicates that there is less chlorophyll in them (chlorophyll is the substance that converts light energy from the sun to sugar energy for the tree). The new leaves are probably producing less energy for the tree and have a shorter growing season, too. These problems may still be present the following spring.

The shortage of energy causes the tree to respond in several ways. The most obvious is the dieback of twigs and branches that occurs especially during the winter months and that becomes evident in the spring. Usually the top twigs and

Figure 5.—Comparison of an undefoliated tree (*A*) with a defoliated/refoliated tree (*B*). Notice that the leaves are a lighter green, smaller, and fewer in number on the refoliated tree.

branches die first. When tip branches die, old buds on the older branches sprout; in severe cases this sprouting occurs on the larger branches and trunk and makes the tree unattractive (fig. 6).

On living branches, the amount of new twig growth is less than normal—sometimes only one-tenth as much as on undefoliated trees. Internal growth is also affected: less wood is produced in the annual ring. This is not so important to people who own trees mainly for shade or beauty, but to foresters who grow trees for wood products it can mean considerable economic loss.

Roots depend on the leaves for food, too. When defoliation reduces food production, many small feeder roots can die. These roots absorb minerals and most of the water needed for tree growth. With fewer feeder roots, fewer minerals and less water are absorbed and sent to the leaves, and food production by the leaves is lowered even more.

6

Figure 6.—An oak tree showing the effects of defoliation and sprouting of the tree in response to branch death in the top of the tree.

3. How many years in succession has defoliation occurred?

One year of defoliation is bad, but 2 or 3 years of defoliation is worse. Even defoliation that does not cause the tree to refoliate is harmful if it is repeated for several years. A weak tree often suffers after only one season of defoliation. But even a healthy tree can die if defoliated 2 or 3 years in a row, especially if the tree refoliates each time it is defoliated. A defoliated tree begins the new season with a considerable handicap, and a repeat performance weakens the tree further and lessens its chances for survival.

4. When during the year was the tree defoliated?

No time is right for defoliation, but the best time would be either very early or very late in the growing season. Early defoliation gives the tree a longer time to recover before natural autumn defoliation occurs. Defoliation late in the season is less harmful because the tree has completed most of its growth, has stored most of its food, and is getting ready to do its normal autumn shedding. Also, the tree usually won't refoliate this late in the season even if all the foliage is eaten. However, several years of defoliation even at these less critical times can still be bad for the tree.

The worst time for defoliation is 4 to 6 weeks after buds open in the spring, when the tree is growing rapidly and food reserves in the shoots and roots are lowest. Unfortunately, this is exactly when the gypsy moth is doing most of its feeding. With such low food supplies, the tree cannot feed all its branches and roots until new leaves are formed; some die, and the tree is weakened.

5. What were the weather conditions after defoliation?

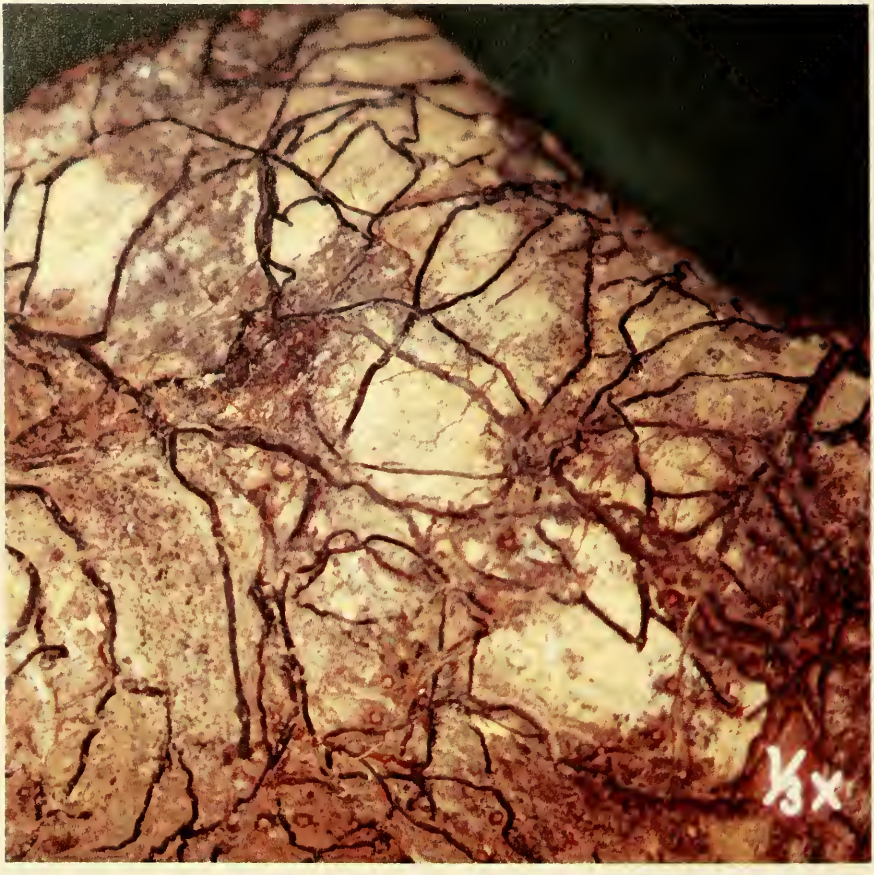
7

How badly a tree is weakened depends on how quickly new leaves are formed and how much food they produce. Both are influenced by the growing conditions or weather. Too much rain during refoliation may set the stage for leaf diseases caused by fungi (fig. 7), and the tree may be defoliated again in the same season.

Dry weather is just as bad. If a tree lacks moisture during refoliation, leaf growth is poor, and these small leaves produce less food. If dry weather continues, food production is lowered because leaves need lots of water to manufacture food. If dryness occurs with high temperatures, leaves may also be scorched.

Figure 7.—Leaves of white oak showing symptoms of a fungus disease.

6. Did disease organisms and other insects attack the tree?



8

The death blow to many trees after defoliation comes from organisms we call "opportunists." They take advantage of the weakening effect that defoliation has on a tree. If the tree had not been defoliated, these organisms would not succeed in attacking the tree. One such organism is a root-attacking fungus called shoestring root rot, which forms black shoelacelike structures on the surface of the roots and in the soil (fig. 8). Weak, dead, or dying roots may provide entrance places for this fungus, which can then kill other roots. The fungus, which grows in the food-and-water-carrying tissues of the roots, restricts the amount of water and minerals that is carried to the leaves and prevents food from going to other roots (fig. 9). The results are more dead roots and greater water and nutrient problems.

Figure 8.—Section of root showing the black shoestringlike structures of the shoestring root rot fungus growing on the bark surface.

9

Figure 9.—Dead oak tree with white fans of the shoestring root rot fungus growing on the wood. Fans were exposed by peeling off the bark (right foreground).

10

An insect that takes advantage of primarily oak trees weakened by defoliation is the twolined chestnut borer (fig. 10). This insect attacks the branches and trunk of the tree and chews feeding tunnels in the tissues that move food, water, and minerals to the shoots and roots (fig. 11). These tunnels prevent water, food, and minerals from moving to where they are needed, which causes more leaves, branches, and roots to die.

Figure 10.—Four growth stages the twolined chestnut borer larva, which tunnels in the bark and wood of defoliated oak trees.

11

12

The combination of the fungus in the roots and borers in the shoots will obviously result in a dead tree. In many instances a tree will die rapidly, especially late in the summer during hot, dry weather. The leaves suddenly turn brown and the tree dies (fig. 12).

Unfortunately both of these organisms operate hidden beneath the bark (figs. 9 and 11), and by the time they are visible, the damage has been done. Currently there is no effective way to keep the fungus from attacking the roots or to kill the fungus once it enters the roots, but the borer can be controlled with insecticide.

Figure 11.—Dead oak tree showing the feeding tunnels created by larvae of the twolined chestnut borer. Tunnels were exposed by removing the bark.

Figure 12.—Tree showing symptoms of twolined borer and shoestring fungus attack. Leaves brown suddenly during hot, dry weather, usually in August, and the tree then dies.

7. How healthy or vigorous was the tree before defoliation?

But even in the presence of "opportunistic" organisms and after several successive years of severe defoliation, a tree *can* survive if it was in good health when defoliated. Stresses such as drought, soil compaction, or disturbance during construction can weaken a tree. These stresses interfere indirectly with food production and may reduce the amount of stored food reserves or even cause some twig and root death. A tree weakened by stress will be more vulnerable than a healthy tree to the effects of gypsy moth defoliation.

How can you help your tree tolerate defoliation? First and foremost, keep your tree healthy. Water and fertilize it properly, especially during stress conditions such as drought. Try to avoid other stress inducers such as soil compaction, waterlogging, competition from turf grasses, or intrusions from driveways and sidewalks. When you plant a new tree, avoid these situations and conditions that cause stress to the tree. Give the root system adequate growing room and mulch it for proper aeration of the roots. If possible, keep a mulched area around the tree. Plant the proper tree in the proper place, and consult professionals if you aren't sure. Cared-for trees are healthier and will tolerate defoliation better.

Protect your tree from being defoliated with carefully applied, commercially safe insecticides. If the tree is small, the caterpillars

13

can be picked off. If your tree gets defoliated in spite of your efforts and it refoliates, care for it during refoliation. If moist conditions prevail, be prepared to spray the leaves with fungicide at the first sign of leaf disease. In very dry weather, water your tree while it is refoliating to help early leaf growth and encourage healthy leaves. Fertilize your tree in the fall or early spring before leaves appear to help replace minerals lost during defoliation.

Figure 13.—Adult beetle of the twolined chestnut borer, which lays eggs on the bark of oak trees in late spring and early summer. Note the two red-brown lines on the wing covers, from which the borer gets its name.

Borer attack can be reduced by spraying the branches and trunk of the tree with an insecticide registered for use against borers. Spraying should be done during the month of June, when the beetle stage of the borer is laying eggs on the bark surface (fig. 13).

By applying these measures, your tree should survive a defoliation even if it loses all its leaves and refoliates. But once your tree has been defoliated, take extra precautions not to let it happen again next year.

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